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SEQUENCE LISTING

<110> Rufer, Andreas Walter  
Sauer, Brian Lee

<120> Method for Selecting Recombinase Variants with Altered  
Specificity

<130> OMRF 178

<140> 09/544,045

<141> 2000-04-06

<150> 60/127,977

<151> 1999-04-09

<160> 68

<170> PatentIn Ver. 2.1

<210> 1

<211> 343

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Cre

a' <400> 1

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val  
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Asp Met Phe Arg  
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val  
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe  
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala  
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn  
85 90 95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala

100 105 110  
 Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly  
 115 120 125  
 Glu Arg Ala Lys Gln Ala Leu Ala Phe Glu Arg Thr Asp Phe Asp Gln  
 130 135 140  
 Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn  
 145 150 155 160  
 Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu  
 165 170 175  
 Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asp Gly Gly Arg  
 180 185 190  
 Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly  
 195 200 205  
 Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Arg Trp  
 210 215 220  
 Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys  
 225 230 235 240  
 Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Gln Leu  
 245 250 255  
 Ser Thr Arg Ala Leu Glu Gly Ile Phe Glu Ala Thr His Arg Leu Ile  
 260 265 270  
 Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Leu Ala Trp Ser Gly  
 275 280 285  
 His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val  
 290 295 300  
 Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Thr Asn Val Asn Ile  
 305 310 315 320  
 Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val  
 325 330 335  
 Arg Leu Leu Glu Asp Gly Asp  
 340

a!  
 cont.

<210> 2  
<211> 13  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: Inverted  
Repeat Sequence

<220>  
<223> N at sites 1-3 and 6-7 is either A, T, G or C

<400> 2  
nnnacnncgt ata

13

<210> 3  
<211> 34  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: variant lox  
sites

<220>  
<223> N at sites 1-3, 6-7, 14-21, 28-29, and 32-34 is  
either A, G, C, or T

<400> 3  
nnnacnncgt atannnnnnn ntatacgngg tnnn

34

<210> 4  
<211> 33  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: variant lox  
sites

<400> 4  
gatacaacgt atataccttt ctatacgttg tat

33

<210> 5  
<211> 34

a!  
cont

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Specific and  
Non-specific sequences for Cre recombinase

<220>

<223> N at sites 1-3, 14-21, or 32-34 is either A, G, C,  
or T

<400> 5

nnnacttcgt atannnnnnn ntatacgaag tnnn

34

<210> 6

<211> 8

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:  
Oligonucleotide

<400> 6

atrabygc

8

<210> 7

<211> 34

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 7

ataacttcgt ataattgatg ctatacgaag ttat

34

<210> 8

<211> 29

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 8  
aaataatcta gactgagtgt gaaatgtcc

29

<210> 9  
<211> 31  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 9  
atatataagc ttatcattta cgcgttaatg g

31

<210> 10  
<211> 33  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 10  
ataagcggcc gctgagcttg gctgttttgg cgg

33

<210> 11  
<211> 36  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 11  
gccgtctcga gagagtttgt agaaacgcaa aaaggg

36

<210> 12  
<211> 30  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

a!  
Cont.

<400> 12  
gtcaagctag ctagcagggt tcccgactgg

30

<210> 13  
<211> 36  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 13  
acattgcggc cgcagatctc ctctagagtc gacctg

36

<210> 14  
<211> 20  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 14  
tttgggctag cgaattcgag

20

<210> 15  
<211> 20  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 15  
tttgggccag ctaaacaatgc

20

<210> 16  
<211> 20  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

a!  
Cont.

<400> 16  
cggtgggaga atgttaatcc

20

<210> 17  
<211> 18  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 17  
ggacacagtg cccgtgtc

18

<210> 18  
<211> 21  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 18  
tctgcgttct gatttaattct g

21

<210> 19  
<211> 18  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 19  
ccaggccagg tatctctg

18

<210> 20  
<211> 22  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

a!  
cont:

<400> 20  
gtacgtgaga tatctttaac cc

22

<210> 21  
<211> 22  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 21  
ttgctggata gtttttactg cc

22

<210> 22  
<211> 45  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 22  
gctatcaact cgcgccctgg gagggatttt tgaagcaact catcg

45

<210> 23  
<211> 45  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer

<400> 23  
gagttgcttc aaaaatccct cccagggcgc gagttgatag ctggc

45

<210> 24  
<211> 45  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: primer



<400> 24

gctatcaact cgcgccctgg cagggatttt tgaagcaact catcg

45

<210> 25

<211> 45

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: primer

<400> 25

gagttgcttc aaaaatccct gccagggcgc gagttgatag ctggc

45

<210> 26

<211> 45

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: primer

<220>

<223> N at sites 17-25 is either A, G, C, or T

<400> 26

gctatcaact cgcgccnnnn nnnnnatttt tgaagcaact catcg

45

<210> 27

<211> 45

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: primer

<220>

<223> N at sites 17-25 is either A, G, C, or T

<400> 27

gagttgcttc aaaaatnnnn nnnnnggcgc gagttgatag ctggc

45

<210> 28

<211> 1172

a!  
cont

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: wtCre

<400> 28

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tttgggctag cgaattcgag ctcggtaccc ggggatcctc tagactgagt gtgaaatgtc 60
caatttactg accgtacacc aaaatttgcc tgcattaccg gtcgatgcaa cgagtgatga 120
ggttcgcaag aacctgatgg acatgttcag ggatcgccag gcgttttctg agcatacctg 180
gaaaatgctt ctgtccgttt gccggtcgtg ggcgccatgg tgcaagttga ataaccggaa 240
atggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300
tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcggtc 360
cgggctgcc aagaccaagt acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420
agaaaaacgt gatgccggtg aacgtgcaaa acaggctcta gcgttcgaac gactgattt 480
cgaccagggt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540
atttctgggg attgcttata acaccctgtt acgtatagcc gaaattgcc ggatcagggt 600
taaagatata tcacgtactg acgggtgggag aatgttaatc catattggca gaacgaaaaac 660
gctgggttag accgcaggtg tagagaaggc acttagcctg ggggtaacta aactggtcga 720
gcgatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgcggggt 780
cagaaaaaat ggtgttgccg cgccatctgc caccagccag ctatcaactc gcgccctgga 840
agggattttt gaagcaactc atcgattgat ttacggcgct aaggatgact ctggtcagag 900
atacctggcc tggctctggac acagtgcccg tgcggagcc gcgcgagata tggcccgccg 960
tggagtttca ataccggaga tcatgcaagc tgggtggctg accaatgtaa atattgtcat 1020
gaactatata cgtaacctgg atagtgaac aggggcaatg gtgcgcctgc tgggaagatgg 1080
cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcggatga gagaagattt 1140
tcagcctgat acagattaaa tcagaacgca ga 1172
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<210> 29

<211> 1172

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: mxoxox1

<400> 29

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tttgggctag cgaattcgag ctcggtaccc ggggatcctc tagactgagt gtgaaatgtc 60
caatttactg accgtacacc aaaatttgcc tgcattacct gtcgatgcaa cgagtgatga 120
ggttcgcaag aacctgatgg ccatgttcag ggatcgccag gcgttttctg agcatacctg 180
gaaaatgctt ctgtccgttt gccggtcgtg ggcgccatgg tgcaagttga ataaccggaa 240
atggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300
tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcggtc 360
cgggctgcc aagaccaagt acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420
agaaaaacgt gatgccggtg aacgtgcaaa acaggctcta gcgttcgaac gactgattt 480
cgaccagggt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540
atttctgggg attgcttata acaccctgtt acgtatagcc gaaattgcc ggatcagggt 600
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taaagatatc tcacgtacta acggtgggag aatgttaatc catattggca gaacgaaaac 660  
 gctgggttagc accgcaggtg tagagaaggc acttagtctg ggggtaacta aactgggtcga 720  
 gcgatggatt tccatctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780  
 cagaaaaaat ggtgttgccg cgccatctgc caccagccag ctatcaactc gcgccctggg 840  
 agggattttt gaagcaactc atcgattgat ttacggcgct aaggatgact ctggtcagag 900  
 atacctggcc tggctcggac acagtgcccg tgctggagcc gcgcgagata tggcccgccg 960  
 tggagtttca ataccggaga tcatgcaagc tgggtggctg accaatgtaa atattgtcat 1020  
 gaactatatc cgtaacctgg atagtgaac aggggcaatg gtgcgcctgc tgggaagatgg 1080  
 cgattagcca ttaacgcgta aatgataagc ttggtgtttt tggcggatga gagaagattt 1140  
 tcagcctgat acagattaaa tcagaacgca ga 1172

<210> 30

<211> 1172

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: mxoxox2

<400> 30

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 caattttactg accgtacacc aaaatttgcc tgcattacct gtcgatgcaa cgagtgatga 120  
 ggttcgcaag aacctgatgg acatgttcag ggatcgccag gcgttttctg agcatacctg 180  
 gaaaatgctt ctgtccgttt gccggtcgtg ggcggcatgg tgcaagttga ataaccggaa 240  
 atgggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300  
 tctggcagta aaaactatcc agcaacatctt gggccagcta aacatgcttc atcgtcggtc 360  
 cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420  
 agaaaacggt gatgccgggt aacgtgcaaa acaggtctta gcgttcggac gcaactgattt 480  
 cgaccagggt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540  
 atttctgggg attgcttata acacctgtt acgtatagcc gaaattgcca ggatcagggt 600  
 taaagatatc tcacgtactg acggtgggag aatgttaatc catattggca gaacgaaaac 660  
 gctgggttagc accgcaggtg tagagaaggc acttagcctg ggggtaacta aactgggtcga 720  
 gcgatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780  
 cagaaaaaat ggtgttgccg cgccatctgc caccggccag ctatcaactc gcgccctggg 840  
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 atacctggcc tggtcgggac acagtgcccg tgctggagcc gcgcgagata tggcccgccg 960  
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 gaactatatc cgtaacctgg atagtgaac aggggcaatg gtgcgcctgc tgggaagatgg 1080  
 cgattagcca ttaacgcgta aatgataagc ttggtgtttt tggcggatga gagaagattt 1140  
 tcagcctgat acagattaaa tcagaacgca ga 1172

<210> 31

<211> 1172

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: mxoxox3

<400> 31

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caatttactg accgtacacc aaaatttgcc tgcattaccg atcgatgcaa cgagtgatga 120
ggttcgcaag aacctgatgg acatgttcag ggatcgccag gcgttttctg agcatacctg 180
gaaaatgctt ctgtccgttt gccggtcgtg ggcgccatgg tgcaagttga ataaccggaa 240
atggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300
tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcggtc 360
cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420
agaaaacggt gatgccggtg aacgtgcaaa acaggctcta gcgttcgaac gcaactgattt 480
cgaccagggt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540
atttctgggg attgcttata acaccctggt acgtatagcc gaaattgccg ggatcagggg 600
taaagatata tcacgtacta acggtgggag aatgttaatc catattagca gaacgaaaac 660
gctgggttagc accgcagggt tagagaaggc acttagcctg ggggtaacta aactggtcga 720
gcaatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780
cagaaaaaat ggtgttgccg cgccatctgc caccagccgg ctatcaactc gcgccctggg 840
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tggagtttca atactggaga tcatgcaagc tgggtggctg accaatgtaa atattgtcat 1020
gaactatata cgtaacctgg atagtgaac aggggcaatg gtgcgcctgc tggaaagatgg 1080
cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcggtatg gagaagattt 1140
tcagcctgat acagattaaa tcagaacgca ga 1172
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<210> 32

<211> 1172

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: mxoxox4

<400> 32

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ggttcgcaag aacctgatgg acatgttcag ggatcgccag gcgttttctg agcatacctg 180
gaaaatgctt ctgtccgttt gccggtcgtg ggcgccatgg tgcaagttga ataaccggaa 240
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tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcggtc 360
cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420
agaaaacggt gatgccggtg aacgtgcaaa acaggctcta gcgttcaaac gcaactgattt 480
cgaccagggt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540
atttctgggg attgcttata acaccctggt acgtatagcc gaaattgccg ggatcagggg 600
taaagatata tcacgtactg acggtgggag aatgttaatc catattggca gaacgaaaac 660
gctgggttagc accgcagggt tagagaaggc acttagcctg ggggtaacta aactggtcga 720
gcgatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780
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cagaaaaaat ggtgttgccg cgccatctgc caccagccag ctatcaactc gcgccttggg 840  
 agggattttt gaagcaactc atcgattgat ttacggcgct aaggatgact ctggtcagag 900  
 ataccaggcc tgggtctggac acagtgcccg tgcggagcc gcgcgagata tggcccgccg 960  
 tggagtttca ataccggaga tcatgcaagc tgggtggctgg accaatgtaa atattgtcat 1020  
 gaactatata cgtaacctgg atagtgaac aggggcaatg gtgcgcctgc tggaagatgg 1080  
 cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcgatga gagaagattt 1140  
 tcagcctgat acagattaaa tcagaacgca ga 1172

<210> 33  
 <211> 1172  
 <212> DNA  
 <213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence: mxoxox5

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 caatttactg accgtacacc aaaatttgcc tgcattaccg gtcgatgcaa cgagtgatga 120  
 ggttcgcaag aacctgatgg ccatgttcag ggatcgccag gcgttttctg agcatacctg 180  
 gaaaaatgctt ctgtccggtt gccggtcgtg ggcggcatgg tgcaagttga ataaccggaa 240  
 atgggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300  
 tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcagtc 360  
 cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420  
 agaaaaacgtt gatgccggtg aacgtgcaaa acaggctcta gcgttcgaac gcaactgattt 480  
 cgaccagggtt cgttcactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540  
 atttctgggg attgcttata acaccctgtt acgtatagcc gaaattgcca ggatcagggt 600  
 taaagatata tcacgtactg acggtgggag aatgttaata catattggca gaacgaaaac 660  
 gctggttagc accgcagggt tagagaaggc acttagcctg ggggtaacta aacaggtcga 720  
 gcgatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780  
 cagaaaaaat ggtgttgccg cgccatctgc caccagccag ctatcaactc gcgccttggg 840  
 agggattttt gaagcaactc atcgattgat ttacggcgct aaggatgact ctggtcagag 900  
 atacctggcc tgggtctggac acagtgcccg tgcggagcc gcgcgagata tggcccgccg 960  
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 gaactatata cgtaacctgg atagtgaac aggggcaatg gtgcgcctgc tggaagatgg 1080  
 cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcgatga gagaagattt 1140  
 tcagcctgat acagattaaa tcagaacgca ga 1172

<210> 34  
 <211> 1172  
 <212> DNA  
 <213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence: mxoxox6

<400> 34

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caattttactg accgtacacc aaaatttgcc tgcattaccg gtcgatgcaa cgagtgatga 120  
gggttcgaag aacctgatgg acatgttcag ggatcgccag gcgttttctg agcatacctg 180  
gaaaatgctt ctgtccgttt gccggtcgtg ggcggcatgg tgcaagttga ataaccggaa 240  
atggtttccc gcagaacctg aagatgttcg cgattatctt ctatatcttc aggcgcgcgg 300  
tctggcagta aaaactatcc agcaacattt gggccagcta aacatgcttc atcgtcggtc 360  
cgggctgcca cgaccaagtg acagcaatgc tgtttcactg gttatgcggc ggatccgaaa 420  
agaaaacgtt gatgcgggtg aacgtgcaaa acaggctcta gcgttcgaac gcactgattt 480  
cgaccagggtt cgttccactca tggaaaatag cgatcgctgc caggatatac gtaatctggc 540  
atttctgggg attgtttata acaccctgtt acgtatagcc gaaattgccg ggatcagggt 600  
taaagatata tcacgtactg acggtgggag aatgttaatc catattggca gaacgaaaac 660  
gctgggttagc accgcagggtg tagagaaggc acttagcctg ggggtaacta aactggtcga 720  
gcgatggatt tccgtctctg gtgtagctga tgatccgaat aactacctgt tttgccgggt 780  
cagaaaaaat ggtgttgccg cgccatctgc caccagccag ctatcaactc gcgccctggg 840  
agggatTTTT gaagcaactc atcgattgat ttacggcgct aaggatgact ctggtcagag 900  
ataccaggcc tgggtctggac acagtgcctg tgctggagcc gcgcgagata tggcccgcgc 960  
tggagtttca ataccggaga tcatgcaagc tgggtggtgg tccaatgtaa atattgtcat 1020  
gaactatata cgtaacctgg atagtgaac aggggcaatg gtgcgcctgc tgggaagatgg 1080  
cgattagcca ttaacgcgta aatgataagc ttggctgttt tggcgatga gagaagattt 1140  
tcagcctgat acagattaaa tcagaacgca ga 1172

<210> 35

<211> 343

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: mxoxoxl

<400> 35

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val  
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Ala Met Phe Arg  
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val  
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe  
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala  
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn

85

90

95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala  
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly  
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Glu Arg Thr Asp Phe Asp Gln  
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn  
145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu  
165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asn Gly Gly Arg  
180 185 190

Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly  
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Arg Trp  
210 215 220

Ile Ser Ile Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys  
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Gln Leu  
245 250 255

Ser Thr Arg Ala Leu Gly Gly Ile Phe Glu Ala Thr His Arg Leu Ile  
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Leu Ala Trp Ser Gly  
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val  
290 295 300

Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Thr Asn Val Asn Ile  
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val  
325 330 335

Arg Leu Leu Glu Asp Gly Asp

<210> 36  
 <211> 343  
 <212> PRT  
 <213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: mxoxox2

<400> 36

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val  
 1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Asp Met Phe Arg  
 20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val  
 35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe  
 50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala  
 65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn  
 85 90 95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala  
 100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly  
 115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Gly Arg Thr Asp Phe Asp Gln  
 130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn  
 145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu  
 165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asp Gly Gly Arg  
 180 185 190



Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly  
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Arg Trp  
210 215 220

Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys  
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Gly Gln Leu  
245 250 255

Ser Thr Arg Ala Leu Gly Gly Ile Phe Glu Ala Thr His Arg Leu Ile  
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Leu Ala Trp Ser Gly  
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val  
290 295 300

Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Thr Asn Val Asn Ile  
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val  
325 330 335

Arg Leu Leu Glu Asp Gly Asp  
340

<210> 37

<211> 343

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: mxoxox3

<400> 37

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Ile  
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Asp Met Phe Arg  
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val  
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe  
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala  
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn  
85 90 95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala  
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly  
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Glu Arg Thr Asp Phe Asp Gln  
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn  
145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu  
165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asn Gly Gly Arg  
180 185 190

Met Leu Ile His Ile Ser Arg Thr Lys Thr Leu Val Ser Thr Ala Gly  
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Gln Trp  
210 215 220

Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys  
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Arg Leu  
245 250 255

Ser Thr Arg Ala Leu Gly Gly Ile Phe Glu Ala Thr His Arg Leu Ile  
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Leu Ala Trp Ser Gly  
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val  
290 295 300

Ser Ile Leu Glu Ile Met Gln Ala Gly Gly Trp Thr Asn Val Asn Ile  
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val  
325 330 335

Arg Leu Leu Glu Asp Gly Asp  
340

<210> 38

<211> 343

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: mxoxox4

<400> 38

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val  
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Asp Met Phe Arg  
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val  
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe  
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Cys Leu Gln Ala  
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn  
85 90 95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala  
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly  
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Lys Arg Thr Asp Phe Asp Gln  
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn

145                      150                      155                      160  
 Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu  
                                  165                      170                      175  
 Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asp Gly Gly Arg  
                                  180                      185                      190  
 Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly  
                                  195                      200                      205  
 Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Arg Trp  
                                  210                      215                      220  
 Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys  
 225                      230                      235                      240  
 Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Gln Leu  
                                  245                      250                      255  
 Ser Thr Arg Ala Leu Glu Gly Ile Phe Glu Ala Thr His Arg Leu Ile  
                                  260                      265                      270  
 Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Gln Ala Trp Ser Gly  
                                  275                      280                      285  
 His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val  
                                  290                      295                      300  
 Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Thr Asn Val Asn Ile  
 305                      310                      315                      320  
 Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val  
                                  325                      330                      335  
 Arg Leu Leu Glu Asp Gly Asp  
                                  340

<210> 39

<211> 343

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: mxoxox5

<400> 39

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val  
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Ala Met Phe Arg  
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val  
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe  
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala  
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn  
85 90 95

Met Leu His Arg Gln Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala  
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly  
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Glu Arg Thr Asp Phe Asp Gln  
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn  
145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu  
165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asp Gly Gly Arg  
180 185 190

Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly  
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Gln Val Glu Arg Trp  
210 215 220

Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys  
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Gln Leu  
245 250 255

Ser Thr Arg Ala Leu Gly Gly Ile Phe Glu Ala Thr His Arg Leu Ile  
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Leu Ala Trp Ser Gly  
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val  
290 295 300

Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Ser Asn Val Asn Ile  
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val  
325 330 335

Arg Leu Leu Glu Asp Gly Asp  
340

<210> 40

<211> 343

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: mxoxox6

<400> 40

Met Ser Asn Leu Leu Thr Val His Gln Asn Leu Pro Ala Leu Pro Val  
1 5 10 15

Asp Ala Thr Ser Asp Glu Val Arg Lys Asn Leu Met Asp Met Phe Arg  
20 25 30

Asp Arg Gln Ala Phe Ser Glu His Thr Trp Lys Met Leu Leu Ser Val  
35 40 45

Cys Arg Ser Trp Ala Ala Trp Cys Lys Leu Asn Asn Arg Lys Trp Phe  
50 55 60

Pro Ala Glu Pro Glu Asp Val Arg Asp Tyr Leu Leu Tyr Leu Gln Ala  
65 70 75 80

Arg Gly Leu Ala Val Lys Thr Ile Gln Gln His Leu Gly Gln Leu Asn  
85 90 95

Met Leu His Arg Arg Ser Gly Leu Pro Arg Pro Ser Asp Ser Asn Ala  
100 105 110

Val Ser Leu Val Met Arg Arg Ile Arg Lys Glu Asn Val Asp Ala Gly  
115 120 125

Glu Arg Ala Lys Gln Ala Leu Ala Phe Glu Arg Thr Asp Phe Asp Gln  
130 135 140

Val Arg Ser Leu Met Glu Asn Ser Asp Arg Cys Gln Asp Ile Arg Asn  
145 150 155 160

Leu Ala Phe Leu Gly Ile Ala Tyr Asn Thr Leu Leu Arg Ile Ala Glu  
165 170 175

Ile Ala Arg Ile Arg Val Lys Asp Ile Ser Arg Thr Asp Gly Gly Arg  
180 185 190

Met Leu Ile His Ile Gly Arg Thr Lys Thr Leu Val Ser Thr Ala Gly  
195 200 205

Val Glu Lys Ala Leu Ser Leu Gly Val Thr Lys Leu Val Glu Arg Trp  
210 215 220

Ile Ser Val Ser Gly Val Ala Asp Asp Pro Asn Asn Tyr Leu Phe Cys  
225 230 235 240

Arg Val Arg Lys Asn Gly Val Ala Ala Pro Ser Ala Thr Ser Gln Leu  
245 250 255

Ser Thr Arg Ala Leu Gly Gly Ile Phe Glu Ala Thr His Arg Leu Ile  
260 265 270

Tyr Gly Ala Lys Asp Asp Ser Gly Gln Arg Tyr Gln Ala Trp Ser Gly  
275 280 285

His Ser Ala Arg Val Gly Ala Ala Arg Asp Met Ala Arg Ala Gly Val  
290 295 300

Ser Ile Pro Glu Ile Met Gln Ala Gly Gly Trp Ser Asn Val Asn Ile  
305 310 315 320

Val Met Asn Tyr Ile Arg Asn Leu Asp Ser Glu Thr Gly Ala Met Val  
325 330 335

Arg Leu Leu Glu Asp Gly Asp  
340

<210> 41

<211> 13  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: loxP

<220>  
<221> misc\_feature  
<222> (6)..(7)  
<223> NN is either TT, TG, GT, GG, TC, CC, and AA

<400> 41  
ataacnncgt ata 13

<210> 42  
<211> 13  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: loxK2

<400> 42  
ataacaacgt ata 13

<210> 43  
<211> 13  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: loxK1

<400> 43  
atacctttgt ata 13

<210> 44  
<211> 34  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: loxP



<400> 44  
ataacttcgt atataccttt ctatagcaag ttat

34

<210> 45  
<211> 34  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: loxK2

<400> 45  
ataacaacgt atataccttt ctatagcttg ttat

34

<210> 46  
<211> 34  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: loxK1

<400> 46  
atacctttgt atataccttt ctatagaaag gtat

34

<210> 47  
<211> 34  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: loxK2 'GG'

<400> 47  
ataacggcgt atataccttt ctatagcccg ttat

34

<210> 48  
<211> 34  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence: loxk2 'CC'

a!  
Cont.

<400> 48

ataaccccggt atataccttt ctatagcggg ttat

34

<210> 49

<211> 34

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: lox K2 'TC'

<400> 49

ataactccgt atataccttt ctatagcgag ttat

34

<210> 50

<211> 34

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: lox K2 'GT'

<400> 50

ataacgctgt atataccttt ctatagcacg ttat

34

<210> 51

<211> 34

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: lox K2 'TG'

<400> 51

ataactgcgt atataccttt ctatagccag ttat

34

<210> 52

<211> 34

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: LoxP

a!  
cont

<400> 52  
ataacttcgt ataatgtatg ctatacgaag ttat

34

<210> 53  
<211> 34  
<212> DNA  
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Lox K1

<400> 53  
gagcctttgt atataccttt ctatacaaag gctt

34

<210> 54  
<211> 34  
<212> DNA  
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: lox K2

<400> 54  
gatacaacgt atataccttt ctatacgttg tatt

34

<210> 55  
<211> 64  
<212> DNA  
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Gene

<400> 55  
gctagcgaat togagcttcg gtaccggggg atcctctaga gtcgacctgc aggcattgcaa 60  
gctt 64

<210> 56  
<211> 33  
<212> DNA  
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:

a!  
cont

oligonucleotide

<400> 56

agcttgagg ctatcatgtc gaccaagcta gca

33

<210> 57

<211> 33

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:  
oligonucleotide

<400> 57

gatctgctag cttggctgac atgatatgct cca

33

<210> 58

<211> 35

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:  
oligonucleotide

<400> 58

gatctgatat ctgcggccgc tgacgtgact cgagt

35

<210> 59

<211> 35

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:  
oligonucleotide

<400> 59

ctagactcga gtcacgtcag cggccgcaga tatca

35

<210> 60

<211> 13

<212> DNA

a!  
Cont.

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:  
oligonucleotide

<400> 60

gaagttccta ttc

13

<210> 61

<211> 8

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:  
oligonucleotide

<400> 61

tctagaaa

8

<210> 62

<211> 13

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:  
oligonucleotide

<400> 62

gtataggaac ttc

13

<210> 63

<211> 27

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:  
oligonucleotide

<400> 63

gaagttccta ttccgaagtt cctattc

27

a!  
Cont.

<210> 64  
<211> 6  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:  
oligonucleotide

<400> 64  
tctaga

6

<210> 65  
<211> 13  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:  
oligonucleotide

<400> 65  
gaagttcata ttc

13

<210> 66  
<211> 13  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:  
oligonucleotide

<400> 66  
gtatatgaac ttc

13

<210> 67  
<211> 13  
<212> DNA  
<213> Artificial Sequence

<400> 67  
gaagttacta ttc

13

a  
Cont

<210> 68  
<211> 13  
<212> DNA  
<213> Artificial Sequence

*a*  
*cont*  
<220>  
<223> Description of Artificial Sequence:  
Oligonucleotide

<400> 68  
gtatagtaac ttc

13

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